

# Fuel Guidance – October '04 Update on In-Line Fuel Sampling Program

By Tom Gahs

The In-Line Fuel Sampling Program provides detailed fuel quality analysis and operational advice for each load of commercial fuel. The program has proven to be incredibly successful. In addition to providing analysis results to the cutters, a web-based fuel quality database has been established to help cutters anticipate what quality fuel is available at ports of call. The data has been used to shape CG commercial fuel policy and practices, and in operational planning. It's also shared with both the US Navy and DESC, and is a key element of an integrated world-wide commercial fuel quality monitoring effort. Customer complaints to the Defense Energy Support Center (DESC), based on the program's data, have improved fuel quality at multiple bunkering locations.

The sampling procedure collects a continuous drip sample from the deck riser connection (the point of custody transfer) over the entire fueling period. Samples are taken for all commercial fuel lifts, whether from a DESC bunkers contractor or the open market, but not for MIL-SPEC products (F-76, or JP-5) from government bulk sources. The program, even if provided by a commercial contractor, no longer tests JP-5 (because the terms of the contract is limited to analyzing diesel fuel). The sample is overnight shipped back to a commercial lab for analysis where it is checked for contract compliance against the Navy Purchase Description for Marine Gas Oil (NPD MGO) and informational testing against F-76 standards that aren't contractually imposed as part of the NPD. The results are interpreted and forwarded back to the cutter along with any operational advice indicated by the results. If the NPD requirements are not met, a Customer Complaint is forwarded to DESC. The data is also entered into the USCG/Nav/DESC fuel quality database so that it's available for both operational and programmatic use.

With only one or two exceptions, all major cutters (WHEC, WMEC, WAGB) have been equipped with sampling equipment. Select 110' WPBs have also been participating in the program. Star contributors have been CGC DAUNTLESS (43 samples), CGC CAMPBELL (21), CGC DILIGENCE (21), CGC ALERT (20), and CGC VIGILANT (20). A total of 369 samples have been analyzed through the 3rd quarter of FY04. All the ILSP samples are currently coming from the Coast Guard.

The database includes samples obtained throughout the U.S., Canada, Central America, the Caribbean, South America, Thailand, Australia, and Antarctica. The web-based database is in an Excel spreadsheet format that can be downloaded and sorted or searched as desired. The initial organization is sorted by country and port. Both a simplistic pass/fail summary is presented for each port, plus all the detailed results for each sample. The database can be accessed from any Work Station III at <http://cgweb.elcalt.uscg.mil/docs/Fueltest/fueltest.htm>. Data is purged from the database after 5 years, so the values will reflect only recent bunkerings.

Overall, the commercial fuel quality has been very high. Because the cost of NPD MGO from DESC bunker contractors is significantly less expensive than either F-76 or JP-5 MIL-SPEC products, increased use of these high quality commercial fuels could significantly reduce the CG's fuel costs. The commercial fuels are not perfect however. That is why the sampling program has been expanded to all the major cutters. As long as the quality of the commercial fuel is monitored, and appropriate operational advice can be provided, burning DESC commercial bunker fuel provides high quality, low cost fuel, at acceptable risk.

The largest number of failures for a property, that was common to both the NPD and F-76 standards, was Cetane Index (9% failure rate). Cetane is a measure of combustion quality for diesel engines. Low Cetane levels can result in difficulty in starting, hard knocking, high exhaust temperatures, and engine damage. Most failures were just marginally under the NPD requirement; several were low enough that blending with other onboard fuel was recommended. Customer Complaints were generated for each failure at a DESC bunker contractor.

For the F-76 parameters (not contractually enforced as part of the NPD) Storage Stability has proven to be the major concern with a 11% failure rate. The Storage Stability test is a pass/fail criteria that corresponds to the fuel remaining stable for a full three year period. Failure does not mean the fuel is currently unstable, only that it would not remain stable for the full three year period. No in-line samples obtained during fueling were currently unstable. This wasn't necessarily true on samples taken from tanks. Diagnostic samples can be taken from storage tanks when shipboard fuel quality problems crop up. Typically these problem tanks have been located near the bottom of the tank burn order and occur when fuel stocks haven't been routinely rotated. Operational advice is provided for each Storage Stability failure to protect the engines from damage if unstable oxygenated fuel were burned. Advice can range from

burning the fuel with caution, being alert for fuel filter clogging, to CASREPin the tanks and disposing of the fuel.

Other F-76 parameters with significant failure rates include Sodium + Potassium (9%) and Calcium (8%) trace metals content. Trace metals are primarily a concern for gas turbines. Sodium + Potassium and Calcium both act as depositors on turbine blades and vanes and can contribute to gas turbine hot section corrosion. The most serious trace metal is Vanadium, which can lead to rapid and catastrophic gas turbine hot section failures and exhaust valve/turbocharger failures on diesels. No Vanadium has ever been detected in any of the In-Line fuel samples.

All other parameters have failure rates  $\leq 5\%$  and are not considered statistically significant. Most failures were only marginal failures and presented no operational risks to either engines or cutter systems. However, operational advice was provided for every failure to mitigate any risks that were associated with those failures.

DESC has recently awarded a follow-on analysis contract to Intertek Caleb Brett. Shipping addresses and procedures have changed, as well as POCs for consumable sampling materials. Data reliability and accuracy is expected to improve, as well as reliability and ease of sample shipping – especially from foreign ports. Finally, we hope to improve analysis turn around time.

Any questions concerning the CG's In-Line Fuel Sampling Program should be directed Tim Curry, ELC-026, voice 410-762-6737, fax 410-762-6203, email [TJCurry@elcbalt.uscg.mil](mailto:TJCurry@elcbalt.uscg.mil).